



New insights for understanding innovation and competence building for sustainable development and social justice

Innovation take off through Industrial Technical Centers in Maghreb Countries: a missing link in NSI or new opportunity?

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Abstract: *While catch up theory assumes that innovation takes place in a linear models and that path dependant trajectories characterizes the innovation process, “innovation take off” rests on the premises that innovation systems need strong policy impulses from government for innovation to effectively take place. Innovation take off is the pre requisite for innovation systems to be operating in a conventional manner. In many Developing countries, like Maghreb countries (Algeria, Tunisia, Morocco), innovation systems construction takes place in a very specific environment characterized by privatization of public concerns, the rise of a strong SMEs sector but with very little experience in the fields of R&D and innovation, and a relatively weak industrial sector in terms of industrial performances, suffering high obsolescence both in terms of human resources and equipment. While the approach in terms of innovation systems is real and attracts a great deal of attention from policy makers, the drive to use Industrial Technical Centre (ITC) as the quickest way to system construction and innovation take off is getting stronger and stronger and rests on the firm belief of policy makers that this is more adapted to the situations of their economies. In most Maghreb countries, essentially French speaking, policies are being worked out to establish ITCs in key strategic sectors: textile, garments, mechanical, electrical, food industries etc. Our contribution addresses the fundamental question of innovation take off in late industrializing countries such as Maghreb countries, both in terms of policies and in terms of conceptual framework. It raises also the issue of the relevance of ITCs as means to trigger off innovation in some late innovating countries. It focuses specifically on the Algerian case using a field study which mobilized about fifteen major industrial innovating firms both public and private concerns, two industrial technical centers and twenty support institutions including*

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ministries, universities, training institutions, valorizing institutions, and industrial associations.

Keywords: Industrial technical centers, innovation, R&D, innovation take off, catch up

Introduction

While catch up theory assumes that innovation takes place in a linear models and that path dependant trajectories characterizes the innovation process, “innovation take off” rests on the premises that innovation systems need strong policy impulses from government for innovation to effectively take place.

Innovation take off is the pre requisite for innovation systems to be operating in a conventional manner. Innovation systems theory has long been characterized by its irrelevance to system construction yet many developing countries have resorted to innovation system approach for system construction.

Many Developing countries, like Maghreb countries (Algeria, Tunisia, Morocco) innovation systems construction takes place in a very specific environment characterized by privatization of public concerns, the rise of a strong SMEs sector but with very little experience in the fields of R&D and innovation, and a relatively weak industrial sector in terms of industrial performances, suffering high obsolescence both in terms of human resources and equipment.

While the approach in terms of innovation systems is real and attracts a great deal of attention from policy makers, the drive to use Industrial Technical Centre (ITC) as the quickest way to system construction and innovation take off is getting stronger and stronger and rests on the firm belief of policy makers that this is more adapted to the situations of their economies. Indeed industrial technical centre appear to satisfy several needs of industry be it private or public concern. The French experience in the field of ITC is well established and seem to have responded adequately to the needs of the industrial SME innovation needs. Many virtues are put forward. (Devalan, 2006)

In most Maghreb countries, essentially French speaking, policies are being worked out to establish ITCs in key strategic sectors: textile, garments, mechanical, electrical, food industries etc. In some countries they exist in different forms and shapes since 1996 such as in Tunisia. Yet innovation take off has not quite taken place of and innovation performances using conventional indicators have remained amongst the lowest in Developing world. This

has not discouraged the other neighboring countries to embark upon a vast programme of ITCs. Morocco has established 9 technical centers while Algeria in the process of starting another 5 ITCs on top of the three existing ones.

Yet when looking at advanced and emerging countries, notably the BRICS, where innovation is effectively taking place, a variety of situations exist: some that have used ITCs or similar forms while others, the majority, have used conventional R&D centers. Will address in this paper the fundamental question of innovation take off in late industrializing countries such as Maghreb countries, both in terms of policies and in terms of conceptual framework. The issue of the relevance of ITCs as means to trigger off innovation in some late innovating countries and raises few questions: To what extent they constitute the shortest way to innovation system construction? What approaches have been used and how effective are they? How can they be fully operational under what terms and conditions?

The paper presented results from a major work we have conducted in 2007/2008 for the European Union MEDA program to launch a wide program of ITCs in Maghreb countries. We will focus specifically on the Algerian case using a field study which mobilized about fifteen major industrial innovating firms both public and private concerns, two industrial technical centers and twenty support institutions including ministries, universities, training institutions, valorizing institutions, and industrial associations. We will also draw heavily on the experience of the two neighboring countries Morocco and Tunisia whose experience is slightly older and rests on the same beliefs. This first section sheds the light on the concepts of Innovation take off, and how it relates to catch up approach, while the second section concentrates of the role of ICTs in innovation systems and the possible short-cuts. The third section looks at the empirical evidence from advanced countries such as France which inspired to a large extent the ITC models used in the Maghreb. The fourth section examines the ITC experience in Maghreb Countries with the emphasis put on Algeria and the CETIM case study. The final section lists some of the problems and issues.

I. INNOVATION DYNAMICS AT THE TAKE OFF STAGE AND THE ROLE OF INDUSTRIAL TECHNICAL CENTRES.

1.1. The necessary take off stage in innovation dynamics.

It is a fact easily documented that major efforts have been made by a significant number of developing countries to launch innovation, pressurized as it were by innovation based

competition. It is also a fact that innovation output remains relatively poor. All kinds of indicators contribute to show that. While investments have most of the time constituted one of the key issue much in the prospects of input theory; '(see figure), financial thrust, by itself does not seem to produce the desirable effect. On the contrary, too much funding has created some undesirable side effects. Thus one of the important problematic is the absorptive capacity of these countries. (Table n°1)

Tableau n°1: Planned and allocated budget in the five year law in Algeria

Units: (billion dinars)

Budget	1999	2000	2001	2002	2003	Total
Planned budget	21,15	31,21	33,66	36,3 8	36,3 8	158. 78
Allocated budget	5,1	4,1	5,1	4,6	5,6	24.5
Allocated/ planned (%)	24,11	13,13	15,15	12,6 4	15,3 9	15.4 3

Sources: National Syndicate of researchers (Algeria).

As shown, less than 16% of the allocated funds could be absorbed. Many explanations have been put forward. The first one relates to the human element which remains a key element in developing countries coupled with a poor institutional and incentive regime. Thus FTP mobilised represents less than 10% of what could be mobilised. Critical mass appears one of the key issues: defined as the level of a mix of human, financial and institutional ingredients.

Thus all ingredients appear to exist without the expected performances unlike advanced countries where similar effort would have yielded interesting results.

We will characterise this as the take off stage which raises slightly different issues than the catch up problematic.

1.2. From take off to catch up.

The take off stage stems much from the take off theory of Rostow. The various stages of growth appear to present a needed path from pr-industrial to opulent society. While the various criticisms have long pointed out to the weakness of the model, its linearity present indeed a weakness from an evolutionary perspective and we would go along with this knowing that standard theory and linearity have largely failed to convey the complex and interactive nature of the innovative act. We will argue that take off is not at the beginning of the process but at the end of a complex process whereby preliminary conditions incorporate this evolutionary perspective of complex, cumulative, path dependant stage. The preliminary conditions as we see it incorporate a set of physical, financial, human, and institutional pre requisites for innovation to take place. It is indeed our main concern that we highlight these preliminary conditions.

Catch up theory rests on different premises. The central issue for catch up from sectors and firms is, in our view trajectories. Trajectories are very relevant when examining the catch up process in African countries considering the variety of industrial experiences. Moreover, Africa is such a heterogeneous continent in terms of resources endowments, geographical locations, and development policy. Trajectory is further supported by the fact that technological accumulated is path dependant, highly localised and context specific. Industry in most African economies is in the emerging stage in spite of the fact that some countries have been trying to industrialise and indeed catch up with the more advanced ones, for nearly forty years: this is the case for example of Algeria and Egypt in North Africa and Nigeria and Kenya in sub-Saharan Africa. South Africa can be singled out as a specific case in this respect, for the fact that industrialising has been going on for well over a century and effective catch up has taken place in certain sectors. Consequently, the catch up process could to be called : “Emerging growth and performances of an industry” (Avnimelech & Teubal, 2006) This way of putting things helps to minimize the scepticism and the potential criticisms that the concept of “catch up” tend to meet and which indeed has some difficulties, particularly when it comes to African countries.

Take off is more appropriate for several reasons: it is firstly more adapted to the current state of the economies where innovation systems are still in the construction stage, characterized mostly by incomplete NSI, weakness or missing links, weak incentive systems and highly entrenched rent-seeking. Secondly it put the emphasis on the necessity to gather certain preliminary conditions to reach a certain critical mass for the taking off to take place. Thirdly, take off appear to be a vital stage in the emerging countries that have evolved in the superior

stage which is catch up stage. This can be seen in Brazil, China, South Korea and India. Finally, take off stage needs a strong State support particularly regarding the institutional dynamics in terms of regulations, salaries and incentive systems, public procurements etc. while the conditions of market dynamics is being put in place in transitional economies such as Maghreb Countries for example.

1.3. Industrial Technical Centres: the missing link

Their main aim is to cater for specific technological demands coming from industry. This sector is usually heterogeneous composed of SMEs that have relatively little means to allocate funds to proper R&D and also to testing control and which require relatively high investments and competencies. In industrial sectors where the majority are big concerns, there may be less needs for ITCs, knowing that they usually are well endowed in funds, human competences and accumulated experience proper R&D and innovative activities. Basically, ICTs are technology transfer structures which have both human capabilities and material means in terms of finance infrastructures and equipment to cater for specific needs of a company, an industry or a sector.

«The success key of ICTs rests on their link position, which is relatively unique. ITCs are indeed the result of a partnership between the public and the private sector at the crossroad of research and industry. They are also at the crossroad of several disciplines as “technology assemblers” capable of analysing, adapting and transferring useful technologies for the design of new products or methods of production. Finally, ITCs constitute a national network located in between regions.² Foss (1999) has called the neo Marshallian approaches to the dynamics of industrial systems. These perspectives share with the industrial network approach both some common predecessors, e.g. Penrose (1959) and Richardson (1972), and the notion that “the industry/the network is more than the sum of the capabilities of firms” (Foss, 1999, p. 7). This perspective is consistent with the basic assumption that relationships between firms can be connected.

It has been frequently underlined that those institutions can go well beyond firms; see, for example, the studies about innovation systems (Lundvall, 1992) or industrial agglomerations (Kirat and Lung, 1999; Maskell, 2001). Those perspectives and that adopted in this paper share the notion that knowledge is partially tacit, limited and disperse in nature.

² Extract from the White Book on ITCs (France)

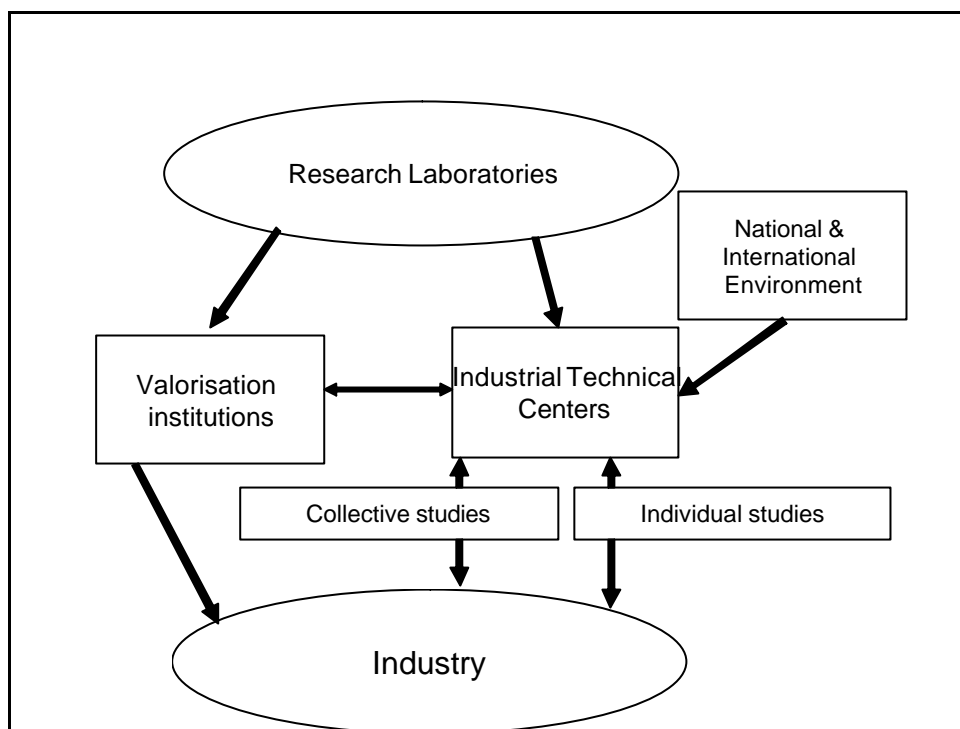
Time matters and the dynamic and idiosyncratic nature of firms is intimately associated to their evolution throughout time, not so much in terms of their given or fixed resources but rather of the capabilities that underlie the extraction of services from the resources they control (Penrose 1959).

The major difference between ITCs and consulting or industrial services bodies is that these latter are capable to undertake studies for the trade as a whole to upgrade technological capabilities and the way they are financed by members of the profession i.e. the enterprises of the sector. This problem occurs from the fact that SMEs are not naturally inclined to put together their efforts and means to solve recurring problems of the profession and thus participate to the general progress of the profession. Similarly they would not put together their testing (or analysing facilities). In effect ITCs put together their means to allow the group to jointly progress.

A recent study also suggests that the potential of ITC's for learning can be associated to their role as providers of services partly duplicating those provided by or in some firms (Mota, J & De Castro, L.M. 2003). 'Some similarity of capabilities in specific areas can help to maintain a great proximity to and relevance for the context in which firms operate, and thus facilitate the processes of dissemination of knowledge in the industry. It also suggests that the motivations and benefits perceived by firms and, in general, the relevance of sharing experiences in this context should be seen in the context of firm's specific and idiosyncratic trajectories. The involvement of firms in technological centre activities may be a means for them to directly or indirectly access the experiences of other firms and individuals in an industrial system. The potential for generation of benefits may be associated to the perceived or real similarity between the activities that may be accessed through those centres and those carried out within the firms themselves, especially the activities that are perceived as most relevant in the context of their relationships with their clients and or suppliers.'

In Norway, the technical-industrial research institutes have similar role of ITCs. In addition to R&D and technical services, the institutes are a significant source of skilled manpower for firms (Nerdrum and Gulbrandsen, 2007). Three central roles for the institutes are highlighted: they are a learning partner for industry, they help increase absorptive capacity, and they constitute a flexible repository in the innovation system by helping firms in peak periods and by reducing the pressure on universities through assisting in teaching and supervision.

Figure n°1: Industrial technical centres at the cross roads



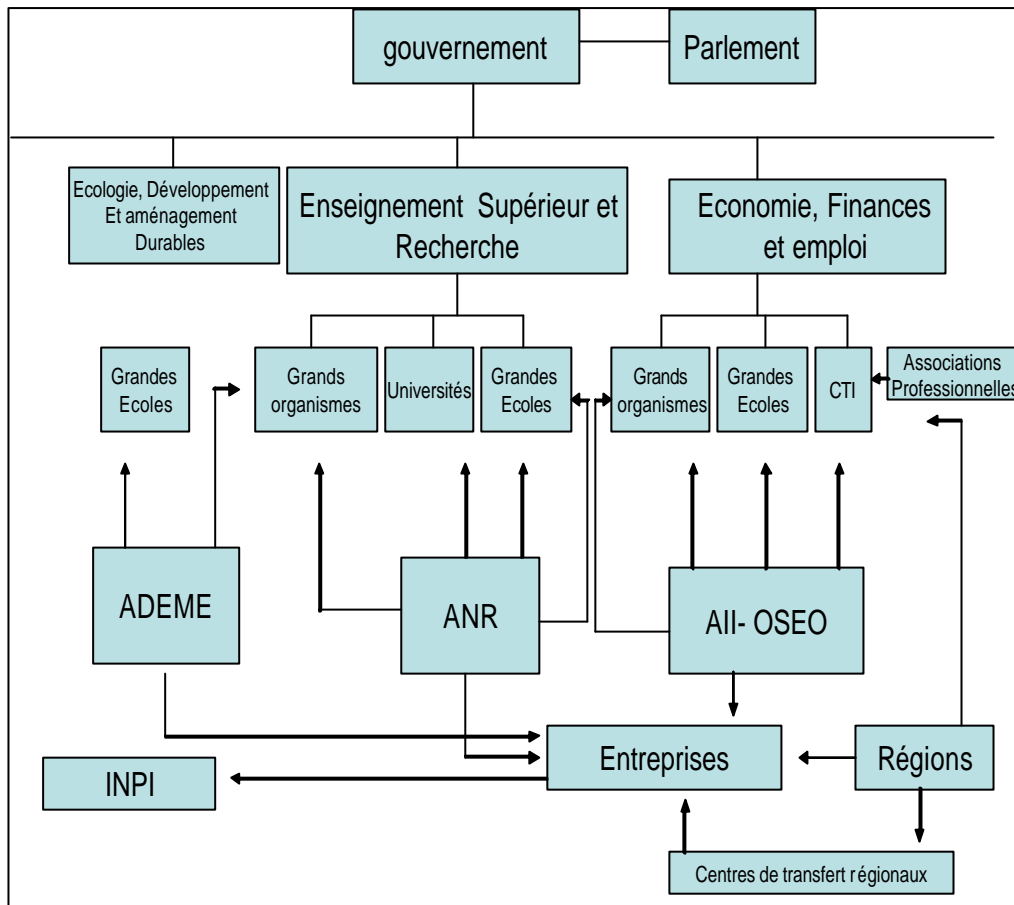
Source: the White Paper on ITCs (France 2004)

III. INDUSTRIAL TECHNICAL CENTERS IN ADVANCED COUNTRIES

In Europe, Industrial technical centres are found in France, in Belgium and in Spain. France plays the role of leadership in this respect. France has been particularly active in terms of number of patents applications. It ranks fourth in the world in 2006 and fifth in the world in terms of the size of R&D spending behind USA, Japan, China and Germany. 17245 patents were nationally registered in 2006 mainly by institutions. An average of 80 000 patents applications is lodged each year at the INPI (Institut National de la propriété Intellectuelle) 78% of which are from foreign concerns. Part of these applications comes from ITCs.

ITCs, in France, are the result from the will of French authorities and industry to put together their means in order to cater for the needs of industrial branches and when the general interest requires it. Their mission is to contribute to the improvement of the quality of products and the improvement of the technological progress of the sector. This require anticipating industrial needs , the conduct of collective R&D projects, the diffusion of technological know-how and the transfer of R&D results to industry.

Figure n°2 : The French National system of innovation



Source: Djeflat et al, 2008

As shown in figure n°2, ITCs are located at the cross roads linked to key players in the French National system of innovation. They are linked to the Grandes Ecoles (such as Ecole Polytechnique), known for their dynamism in innovation , to the ministry of Economy, Finance and employment, to industrial enterprises through their professional associations, to the valorizing agencies such as All-Oseo an finally to the regions.

Most of them were created between 1948 and 1964³ and their original mission was to provide support to the industrial sector, composed to a great extent by SMEs. The legal framework was recently integrated into the Research Law putting thus the emphasis on their R&D function⁴. They constitute currently the first Applied Research Network in France and have been providing for the last fifty years a set of expertise which they would not acquire

³ Law of 22 July 1948

⁴ Recherche (Art. L. 342-1 à L. 342-13).

individually in the fields of R&D. In their role of intermediary institution, between the world of research and that of enterprises, they play the role of facilitators, the exchange of information, the acquisition of know-how and the diffusion of technological progress and technology transfer.

ITCs represent nowadays 4500 collaborators, 50% of whom are engineers, scientists, and managers, (table n°2).

Table n°2: Structure of Industrial technical centers in France

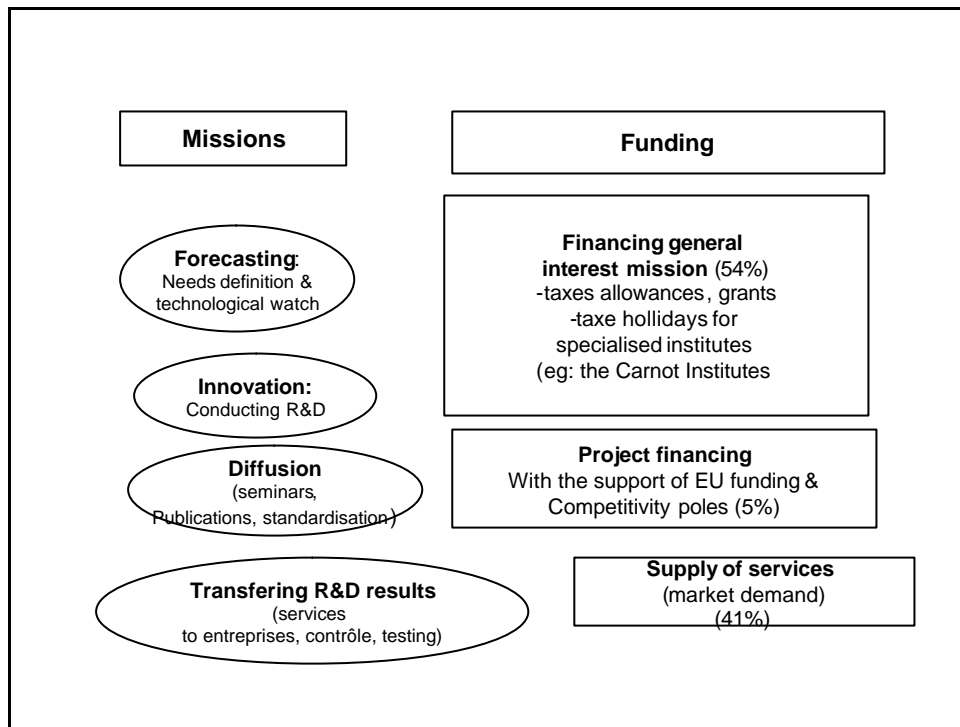
Status	Numbers	Percentages
-Scientists and engineers and managers	2250	50%
-technicians & agents	1530	34%
-employees	720	16%
TOTAL	4500	100%

Source: White Book on ITCs in France (February 2005)

In relation to university laboratories, ITCs are in charge of technologies needed by SMEs. In this respect, they are not in principle in competition with research laboratories but rather in a complementary position and very much in touch with local enterprises and more sensitive to their needs.

Their funding obeys two different regimes : certain of them receive an annual grant from the State Secretary for industry on the basis of the contract established between them and their professional association and the ministry, others have opted for a tax incentive system whereby they receive 0,1% of the tax paid by the profession. They also have a contract with the Ministry. (figure n°3)

Figure n°3: Missions and financial resources of French ITCs



Source: White Book on ITCs France 2005

In Norway, for example, they receive basic grants, they receive the RCN awards “strategic institute programmes” so that general public funding constitute around 13 percent of the institutes’ incomes. The remaining incomes are generated from projects and R&D services provided to national and foreign customers. From a geographical point of view, the 39 ITCs are located in twenty regions; they contribute to the R&D of 70 000 enterprises representing 26 industrial branches. Sixty eight percent of these enterprises have less than 50 employees and 30% between 50 and 500 employees in 2004.

Table n°3: The sixteen industrial Technical Centres in France

Industrial Technical centres	Number of collaborators	Sectors
AFOCEL	100	Forest & Cellulose
CERIB	150	Industrial concrete products
CETEHOR	20	Jewellery, watch making and gold smithing
CETIAT	120	Aéraulics et Thermics
CETIM	730	Mécaniques industry (fabrication, composants, équipements)
CTBA	280	
CTC	110	Wood & furnishing
CTICM	150	Leather and shoes & Maroquinerie
CTDEC	100	Metal constructions
CTIF	130	Décolletage
CTP	50	Black smiting and metal working
CTTB	50	Paper & cardboard
CTTN	50	Tiles et Bricks
IFTH	350	Dying & Cleaning
ITERG	60	Textile & Garments
SFC	50	Corps Gras
		Céramics

Source: Devalan (2006)

Intensive exchange occurs between Tics and both industrial entities and universities: thus annually, 200 these are passed and 50 post-doctoral studies are supported on top of 200 contracts passed with public laboratories. No less than 40 000 meetings took place. Contractual relations are also relatively intensive 34 000 service contracts were passed in 2004. Technology and information diffusion constitute one of the major components: in 2004, 25 journals and magazines were edited and distributed in 200 000 copies to the various stakeholders. This was also helped by 300 seminars attended by 7000 participants. Finally the training component is not negligible: 30 000 people attended one kind of training or another,

In Canada, each province has developed an R&D institute to support the innovation function of local enterprises. Created by the provincial administration, these institutes help to optimise the exploitation of local and territorial resources. In the Québec province, for example, they are called Collegial Centres for Technology Transfer (CCTT)⁵. The 29 CCTT are located in colleges and technical training institutions and form a network transtech. Started as public concerns, they have gradually been transformed since the beginning of 1990 into private enterprises with full time qualified personnel namely as a result of diminishing state funding (subsidies). Their mandate is to provide a technological support to SMEs of the provinces through testing facilities, technical aid and R&D activities. To complete the set up, in the Quebec province, five Liaison and transfer centres (CLT)⁶ were created by government with the objective of liaising between universities and enterprises.

IV. INDUSTRIAL TECHNICAL CENTERS IN MAGHREB COUNTRIES

ITCs appear to have several attractions to Maghreb countries and indeed to LDCs as a whole which are useful to examine. Firstly, they are heavily based on incremental innovation and applied research which in the case of innovation take off situation, represent the bulk of innovation needs. Breakthrough and radical innovation appear at this stage non feasible. Secondly, innovation take off is the most delicate task when it comes to SMEs of the private sector in other the majority of enterprises: experience has shown that ITCs are particularly suited for R&D and innovation for the small scale industry. Thirdly, Innovation take off has to occur often in situations where National Systems of innovation are incomplete unstructured and non finalised (Djeflat 2003): ITCs appear to be particularly suited for this type of NSI. Fourthly, ITCs cater, as seen earlier for collective R&D and innovation needs of small enterprises: they can thus constitute a relatively good substitute to the lack of capabilities and means that SMEs suffer from particularly in LDCs and the Maghreb countries in particular.

The experience of Maghreb countries in ITCs varies from one country to the other. We will look at the experience of Tunisia, Morocco and put more emphasis on Algeria, which the focal country in this study as explained.

⁵ Centres collégiaux de Transfert de Technologie.

⁶ Centres de Liaison et de Transfert

4.1. The *Specialised Technical Centres (CTS)* in Tunisia

Specialised Technical Centres (CTS)⁷ in Tunisia provide technological support to various industrial sectors. However, their role is much broader than French ITCs. They are involved also in economic studies such as prospecting foreign markets for exports, to collect data for the various industries etc. Two types of CTS the old ones created between 1960 and 1990 and those that have been created after 1996 (table n°4).

Table n°4: CTS in Tunisia (2004)

Old CTS		
CTS	Number of collaborators*	Industrial sectors
CNCC	75	Leather and shoes
CETIME	117	Mécanical & Electrical
CTMCCV	88	Mines, Ceramics, Cement, Glassware.
CETTEX	90	Textile & Clothing
Total	370	
New CTS		
CETIBA	24	Wood & Furniture
CTAA	24	Agro-food
CTC	15	Chemistry
PACKTEC	22	Packaging & conditioning
Total	85	

CTS are Public Interest Economic Establishment and appear closer to administrations than enterprises. Their relatively long life allows us to make an assessment. From a quantitative point of view, their growth has been relatively fast as shown in table and they have been able to use 50% of their budget to effectively cover supply of services to industry.

⁷ Centres Techniques Spécialisés

From a qualitative point of view, they have concentrated their activities on supporting the programme launched within the European Free Trade Agreement which requires a massive up-grading of Tunisian enterprises and namely SMEs. The second major task has been the training of competencies in the framework of the Tunisian Continuous Training Programme. The third major task is testing and control. A contrario technical expertise and the aid to the technological evolution of enterprises through R&D activities and innovation have been relatively weak. The initially set objective of financial autonomy is far from being reached: they still rely to a great extent on public funds. Fifty per cent of their budget comes either from the Tunisian Government or from European Union budget. In this respect, their financial viability can be greatly questioned.

4.2. The centre techniques industriels in Morocco.

In Morocco, the ITCs are relatively recent unlike the Tunisian ones. They were created by the Ministry of Industry, Commerce and Economic Upgrading (MICMANE)⁸ with more or less the same objectives as the French ones. In other words, they are in charge of the improvement of the quality of products and the technological progress of the sector, of conducting collective R&D projects, of the diffusion of technological know-how and the transfer of R&D results to industry.

Two stages can be identified in the process of ITCs creation: The first stage started in 2000, and saw the birth of four ITCs with the help and support of the European Commission in the framework of the MEDA1 programme⁹ (table n°5). They started their activities effectively in 2005; the second stage started in 2005 which saw the creation of five more ITCs with roughly the same objectives within the framework of the MEDA 2 Programme. They started being operational in the middle of 2007.

⁸ Ministère de l'Industrie, du commerce et de la mise à niveau de l'Economie Programme d'appui aux entreprises du Maroc, Commission Européenne, Février 2007

⁹ The MEDA 1 programme relates to the Euro-Mediterranean programme which resulted from the Barcelona Treaty signed in 1995 and geared towards the establishment of a Free Trade Zone between Europe and its South Mediterranean Countries.

Table n°5: Moroccan ITCs in the MEDA 1 and MEDA 2 frameworks (2006)

ITCs created in the MEDA 1 framework		
CTI	Industrial sectors	Number of collaborators*
CERIMME	Mechanical & Electrical Metallurgical and Electronics	8
CETEMCO	Construction & Building Materials	15
CETIA	Agro-food	8
CTTH	Textile et Clothing	12
ITCs created in the MEDA 2 framework		
CTPC	Plastics & Rubber	9
CTIBA	Wood & Furniture	5
CMTC	Leather and Maroquinery	5
CETIEV	Automotive Equipments	3
CETIC	Information and Communication Technologies	2

It is still too early to make an assessment of this experience. What can be noted so far, are the various difficulties met and which can be briefly summarised as follows:

- Long Delays to get the building and equipment set up and notably specific testing equipments.

- Difficulties in funding which relies heavily on a specialised Fund which is mostly public funding as seen earlier (EU and MICMANE funds) which is a provisional set up and should be kept until 2010 and not beyond when the various ITCs reach the stage of maturity.

- The still ambiguous status these centres have which is close to associative institutions, but with lucrative objectives and which obviously is a source of problems for the Management of these centres: power delegation, in particular does not seem clear cut and has not been fully operated.

- Finally a weakness in project management oriented technical centres (and particularly R&D oriented) which results from specialised teams in the field.

A survey conducted in 2006¹⁰ seven industrial sectors (Metal, Cellulose, leather, textile, plastics, and wood) and looked at several dimensions of ITCs: legal and regulatory framework, the role of the State, the role of professions, the funding and the running of ITCs. Several key success factors were highlighted. The most important ones being: the vitally important role of the State at the kick off stage, the legal framework which defines the regulations but also the bodies in charge (e.g. the administrative board), and the financing, the necessary initial material and immaterial investments, the initial budget allocated by the State until the industrial sector is in a position to take over. Other key success factors include: the take over by the profession of the centre, which implies that it is in position to run it, to raise the necessary finance (taxes and revenues), through expressing its needs and taking part t the various commissions¹¹.

4.3. Industrial Technical Centres in Algeria: the case of CETIM

Two ITCs exist in Algeria: The CETIM and the CNTC. CNTC has shifted its services more to a kind of CDO i.e. Management Consulting and in particular in the e-consulting far from its initial vocation which included R&D services. It will not be examined here. We will concentrate on CETIM.

The industrial sector as a whole is facing several threats exacerbated by the fact that Algeria is on the point to conclude a treaty with WTO to become a member and has recently joined the free trade zone of Europe. Consequently local enterprises and SMEs in particular, face tough competition coming from foreign companies. To be able to achieve its objectives, they have to rely on the local resources namely those that are provided by the National Scientific and Technological Infrastructures (NSTI). NSTI includes Universities, technical centres, research institutes etc. Local SMEs can also greatly enhance its capabilities through frequent demands and the use of its outputs (products and services). This is similar to the philosophy of public procurements which constituted a key factor in the development of national innovation systems in the OECD countries.

¹⁰ Lachat POA- MI2, Ministry of Industry, Algiers, 2006

¹¹ The agro-food sector was investigated by a UNIDO team separately.

However, the NSTI has suffered several shortcomings and weaknesses which can be highlight briefly. From a quantitative point of view, it has been amputated from important capabilities which were Branch based industrial Research and Development enterprises. They were found in building materials, agro-food industries, textile and so forth. From a qualitative point of view, there has been a proliferation of pseudo consulting bureaus, with limited professionalism and competencies and which could not replace the suppressed R&D entities.

Presentation of CETIM

The CETIM is the main Algerian technical centre for the industry of building materials such as cement, concrete, bricks, tiles, ceramics and plaster. CETIM which provides testing and control in the construction materials has facilities and laboratories for testing, analysis, consulting and expertise. Located in the Willaya of Boumerdes, in the western part of Algeria. It was created in 1998 following the dissolution of the enterprise for the development of the of the construction materials ENDMC. Its activities include technological watch, control and testing, audit and expertise, specific studies and consulting in the field of technology for product and process improvement, specifications and legal control technico-economic studies of various kinds . CETIM has still a limited R&D activity which gradually building up.

Its main mission is to contribute to the technical progress, the improvement of productivity and the development of quality in the building materials industry. Part of this rests on incremental improvement of products and services through R&D activities. For that purpose, it has established close links with the local university of science and technology of Algiers and the university of Boumerdes. It sees itself as the link institution between university and enterprises for all activities related to research, training and information diffusion. Its status is public enterprise whose capital is in the hands of the cement industry (70%) namely ERCE and 10% by the other companies on the sector (ERCC, ERCO and ECDE).

The quality standard of its services are pretty high and are recognized internationally notable the COFRAC¹², the French Committee for Accreditation accreditations for its testing. CETIM has also mandates from the Algerian Committee for quality control for materials (CAQUE)¹³ which is part of the Ministry of Commerce, for the implementation of

¹² Comité Français d'Accréditation

¹³ Comité Algérien pour la Contrôle de qualité des matériaux de construction

certification of the Algerian Standardisation Institute (IANOR)¹⁴, the Agreement of the Ministry of Environment for environmental studies and the agreement for the Ministry of Industry for up-grading skills and competencies of local enterprises and the improvement of their quality insurance system.

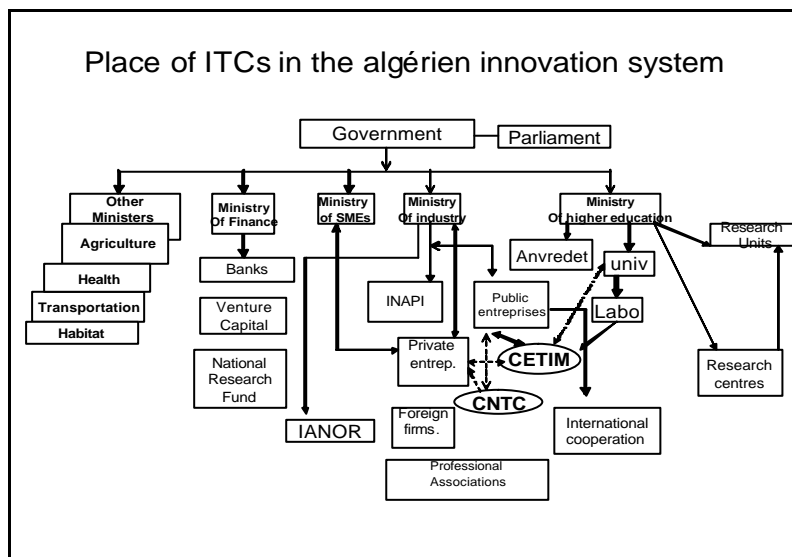
It has ten laboratories for testing and research, and a pluri-disciplinary team of 45 engineers and 37 technicians. The labs are independent from, each other, which might constitute a source of problem in the future. In spite of that, it does not have all the necessary equipment notably for R&D.

In terms of finance, CETIM is fully self financed notably through regular clients and receives neither subsidies nor any kind of funding from the State. This is quite a privileged situation which gives it a large autonomy when it comes to decision-making and, nonetheless could be potential source of constraints when CETIM undertakes important R&D activities.

The position of CETIM in the innovation system

The position of CETIM and CNTC is quite central in the Algerian NSI. As mentioned earlier, it is linked to enterprises (public and private) to universities, to research laboratories. However its linkages are sometimes relatively tenuous.

Figure n°4 : Overview of the Algerian NSI



Source: Djeflat et al (2008)

¹⁴ Institut Algérien de la Normalisation

CETIM has a relatively strategic position in the national innovation system being a precious link institution closely interacting with enterprises and universities. With regards enterprises, CETIM has permanent links with most companies in the building and construction sector. To make it a structural relationship, the most important tool is to associate the most important companies in the trade in the profession in the equity of CETIM. This is a guarantee to have a full workload. Relationships with the companies in the building materials sector are commercial ties of the client-service supplier type.

Their relationships are on made on an annual contractual basis which constitutes the business plan which details implementation conditions: delays, quality, price and payment modalities. Annual contract evaluation and review meetings are organised with each one of the clients. This is also one way to be permanently in touch with their needs.

These enterprises are also associated with the R&D activities which CETIM develops. The scientific board of CETIM is composed of representatives of these enterprises: the board is in charge of elaborating research programmes and their financing. On the other hand, CETIM plays the role of their representative and delegate enterprises vis à vis the official bodies and institutions such as the standardization and regulation body such as the IANOR for example.

Regarding the university, CETIM has two types of relationships: formal and informal relationships. On the formal side, it has a set of agreements with various universities namely three major ones: the university of Annaba, the university of Bejaia, the university of Tizi Ouzou and the university of Boumerdes. It has also established ties with foreign universities namely in Canada. The main object of these contractual relations is the conduct of common R&D activities. On top of these institutional relationships, CETIM has also contractual relations with individual researchers who act as experts and consultants involved in various projects and tasks: taking part to seminars in various fields to answer preoccupations of the industrial sector namely : in environment protection and sustainable development (with the university of Bab Ezzouar) in mining engineering (university of Annaba), in technology of concrete (armed concrete) with Sherbrooke university (Canada) and Metrology with the university of Hull (Canada). Informally, CETIM has established linkages with other universities such as the universities of the centre and in particular with the university of Boumerdes and which entails helping final year students to conduct their research projects in the its laboratories, and which often are poor or missing at the university level.

Two major projects are currently underway: the technical information and documentation centre project and the industrial metrology laboratory.

The technical information and documentation centre The other activities related to Research and Development are the information and documentation technical centre having an interactive data bank covering the whole spectrum of know-how and information in the field of building materials and construction. This bank results also from the codification of all practices and experiences gathered in the field. This constitutes a precious instrument both for CETIM in its watch function and for the enterprises in the field. The need for this centre stems from the necessity of these enterprises and the SMEs in particular to have a watch function and to have the most recent information regarding technical and technological, information, products (including raw materials, semi-finished products and final products), equipments and processes as well as all kind of updated information regarding markets, competition and transactions in the profession. The main missions of the centre are: the management of the data bank, the building of a network of professionals in the field, the production and diffusion of a technical information bulletin. They include also, providing experts for specific consultancy needs, promoting and organising industrial cooperation and finally, animation of training and seminar sessions.

The industrial metrology laboratory mostly to standardise and calibre the equipments used in the trade. The lab. provides also qualified personnel and expertise wherever needed to etalon equipments and testing equipment. This laboratory is geared towards fulfilling a need which is not catered for currently namely due to the poorly equipped and below standard labs in the field of standardization of the ISO 17025. Urgent needs for producers to certify their products and to be able to complete the national system of accreditation.

In terms of performances, CETIM realises most of its work in the form of testing and analysis of products for the industry needs: this represents 40% of its activities; the rest of its workload includes consultancy and technical assistance to members of the profession and R&D activities.

V. PROBLEMS, OBSTACLES AND ISSUES

The first category of problems relates to its rather ambiguous status. It is a limited liability i.e. a private concern and at the same time it is under the authority of the Ministry of industry. The current status of Limited liability drives it to aim at profit-making activities and much less for the general interest as shown in the case of French ITCs. The salaries do not appear to be adequate for the kind of tasks being undertaken and which are relatively demanding. This is source of relatively high turnover.

In practice, several problems are met on the university side as well as on the enterprise side. From the enterprise point of view, problems stem often from the difficulty in properly identifying the type of technology transfer needed for the development of their market and the lack of monitoring and application of the results of R&D projects undertaken by these enterprises. Often, the private sector is not aware enough of the importance of quality control in production, nor of the importance of innovation. Similarly, enterprises of the various sectors do not seem to be prepared to pay an extra tax for the financing of ITCs and prefer to pay the services provided by these centres.

From the university point of view, the main problem resides in the type of research project undertaken and offered to enterprises and which are relatively weak in terms of technology transfer.

Most of these problems are solved by an active participation of ITCs who could play an active role as a link institution between universities and enterprises. They have the capacity to diagnosis the need of enterprises, to select the adequate research project, and help select competent researchers at university level and finally monitor and evaluate research. Their submission to the authority of a Ministry, source of heavy bureaucratic procedures needs to be revised. It could have the status of a non affiliated public enterprise. Salaries particularly for experts need reviewing to stop the brain drain and increase the incentive system. A clearly defined status should allow ITCs to undertake both profit-making and general interest activities. This may need the creation of a specific new status for ITCs with specific bodies to run them i.e. specific committees. ITCs have to be deeply rooted in their branch of activity and its industrial milieu; there is a need to revitalize what already exist.

Concluding remarks

This paper examined the role of Industrial Technical centre in the innovation system in Maghreb countries that are still at the take off stage. It appears that these centres could play a vital role in the promotion of innovation in incomplete and unstructured innovation systems such as the Maghreb ones. The empirical evidence suggests that these centres fulfil many important roles, ranging from providing the necessary and vital information to the industry and technological watch to conducting efficient R&D activity either on an individual or a collective basis and providing valuable networks around and between enterprises in the profession. Their inscription on local, territorial level gives them extra closeness to university and higher education system as a whole and thus they are part of the National Innovation System.

While some of the services rendered may not be classified as R&D activities, but at the take off stage, they can be considered as important by-products and complementary services to R&D and in this respect contribute to broaden the span of NSI activities at the take off stage in Developing to include non traditional and non conventional and yet vital activities for innovation to effectively take place.

As shown in other works the ITCs can be considered to possess “unique” competencies and hold high quality. “A predominant reason to why firms use ITCs is that they lack the skills, the R&D capacity, equipment and methodology to conduct R&D projects in-house” (Nerdrum & Gulbrandsen 2007): ITCs constitute, in this respect an important contribution to firms in their search for innovation. Their contribution rests on their major tasks: they represent a *learning partner* to enterprises. Learning happens primarily through collaborative projects, collective R&D, public programmes oriented towards general interest. Secondly, they contribute to increasing *absorptive capacity* or to overcoming problems of *low absorptive capacity* of current national research system which is a fundamental component of the National Innovation System. While, we have not investigated this dimension deep enough, we could conclude like Nerdrum & Gulbrandsen (2007) that it occurs through two mechanisms : One is through the numerous projects and personal contacts established between industry and the centres staff and the other through the relatively high staff turnover which they suffer from and which benefits industry, consultancy bureaux etc. Third, ITCs have a *lubrication* or *intermediation* role in the research and innovation system. They have close relations to higher education namely through joint laboratories and joint projects. This gives them the possibility to act as a buffer zone between universities and industry with the

beneficial effect this produces and play also an intermediation role between the two. They can therefore help SMEs of the private sector in particular increase their capacity for R&D acting as a *flexible repository* in the national innovation system.

However, their services are still relying on public funding for certain while others have deliberately engaged in self-financing and market demand leading them to charge quasi monopoly pricing in a “what the market can bear” policy. In both cases, ITCs are in a problematic situation which could jeopardize their very existence as a vital link in the NSI chain of value. As a fully funded agency, their role could drift to simple administrative institution and could fail to deliver applied research result and contribute to their valorisation. The short-lived experience of ITCs in Tunisia shows clearly the emergence of this risk. As a conventional market driven enterprise, they face two major risks: the first one is that their monopoly pricing could make them less competitive when the markets are fully opened under the aegis of free trade zones and the second one is the neglect of “collective” industrial needs and general interest which, we have seen are vital at the take off stage.

To avoid either of the pitfalls, it is suggested that a specific and sector oriented status is attributed to ITCs allowing them to fulfil both needs and to benefit from both public funding and self generated income: this is also the key solution for their sustainability.

Bibliography :

AVNIMELECH, G. & TEUBAL, M. “A catching up innovation and technology policy (itp) life cycle model” ppt 2006

From Direct Support to Business Sector R&D/Innovation to Targeting Venture Capital/Private Equity”, January 2006

CARRE, H., (2001) « Capacité technologique et développement dans les PED : cas des industries agro-alimentaires au Sénégal » thèse de Doctorat, USTL,

Le système d'appui technologique aux entreprises de l'Industrie Mécanique du Canada, étude CETIM (France), décembre 2004.

DEVALAN, P (2006) « L'Innovation de rupture : Clé de la compétitivité» Hermes- Science –

Lavoisier-

DJEFLAT, A. (2003) “Les Systèmes Nationaux d’Innovation: entre globalisation et territorialisation» in Michel Rautenberg (dir.) *Dynamiques locales et Mondialisation*, N°Spécial, Revue CLES, l’Harmattan, Octobre, pp. 131-153

DJEFLAT, A. DEVALAN, P. & YUCEF ETTOUMI, F. (2008) « Evaluation des Politiques et Programmes d’innovation dans le secteur industriel» European Commission, Ministry of Industry, Final report. 154 pages

FOSS, N. (1999), “Networks, Capabilities, and Competitive Advantage”, *Scandinavian Journal of Management*, 15, pp. 1-15.

KIRAT, T., LUNG, Y. (1999), “Innovation and proximity – territories as loci of collective learning processes”, *European Urban and Regional Studies*, 6 (1), pp. 27-38.

LACHAT, J.C. (2004) *Accompagnement au processus de modernisation du Ministère de l’Industrie et des Organismes liés. Expertise d’appui à l’Industrie : Centres Techniques. Rapport pour le compte du Ministère de l’Industrie*, novembre.

LUNDVALL, B.A., (1992) *National Systems of Innovations*, Printers Publishers,

MASKELL, P. (2001), “Towards a knowledge-based theory of the geographical cluster”, *Industrial and Corporate Change*, 10 (4), 921-943.

MINISTERE DE L’ECONOMIE, (1997) “Les 4 pages des statistiques industrielles” Sessi, N°84, Décembre

MOTA, J & DE CASTRO, L.M. (2003) “Connecting Capabilities through Technological Centres” Paper prepared for the 19th IMP Conference, University of Lugano, Switzerland 4th – 6th September

NERDRUM, L. & GULBRANDSEN, M. (2007) “The technical-industrial research institutes in the Norwegian innovation system”, *TIK Working paper on Innovation Studies No. 20070614*, NIFU STEP, Oslo, 31 pages

PENROSE, E. (1959/1995), *The Theory of the Growth of the Firm*, Oxford University Press: Oxford.

RICHARDSON, G. (1972), "The organization of Industry", *The Economic Journal*, Sept., pp. 883-896.

YOUCEF ETTOUMI ; F : Projet Tempus JEP 32111_2004 – Interfaces de l'Insertion Professionnelle par les UST- Documents mémoires 2004-2008 - <http://www.usthb.dz>)

White Book on ITCs , (2005) France